United States
Department of
Agriculture

Forest Service

Pacific Northwest
Research Station

Research Paper
PNW-RP-433
January 1991

Future Pacific Rim Flows and Prices of Softwood Logs, Differentiated by Grade

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Abstract

Flora, Donald F.; Anderson, Andrea L.; McGinnis, Wendy J. 1990. Future Pacific Rim flows and prices of softwood logs, differentiated by grade. Res. Pap. PNW-RP-433. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 22 p.

By 2000, prices are expected to rise significantly for medium-grade logs and modestly for low-grade logs. World economic cycles may obscure, however, the upward price trends. Exports from the United States of medium grades are expected to remain stable, while volumes of lower grades are projected to remain level through 1995 and then decline because of competition.

Keywords: Markets (external), supply and demand (forest products), trade (Pacific Rim), log exports.

Summary

With record high log prices for all softwood log grades, a broadening range of prices between low and high grades, and increasingly different supply and demand opportunities for premium versus lower grades, there is an acute need to differentiate among quality strata in market forecasting. This analysis distinguishes four softwood grade groups and projects Pacific Rim prices and flows for the two middle groups. The underlying study employed individual supply and demand relations for each country participating in the trade.

Prices are projected to remain flat for low-grade logs through the mid-1990s and then start a decline lasting into the next century. Prices of higher grades are estimated to rise at least through 2000. Highest, select grades are expected to rise in value indefinitely. United States exports of low-grade logs are projected to remain level through 1995 and then decline because of competition; shipments of high grades are projected to remain roughly stable through 2000. Further decline in the value of the U.S. dollar can be expected to materially improve dollar log prices and export volumes.

Contents

Introduction

This report updates and expands earlier analyses of future markets for small "construction-grade" softwood logs around the Pacific Rim (Flora 1986, Flora and Vlosky 1986). Here, those projections are extended to 2000, projections are added for larger "performance-grade" logs, an additional exchange rate scenario is added, and two projections of the Soviet role are used.

This study is the first published trade analysis distinguishing among log-quality classes. Although the report is based on an econometric analysis, a background in statistics is not required to understand the discussion of projection results and underlying assumptions.

The Log Grades Analyzed

The international softwoods log market involves many sorts (a trade term meaning the sorting of logs into species, size, and quality groups). The wide range of log prices and the relevance of certain sorts to particular regions argue for disaggregating the array into value strata and analyzing each. Intercountry trade data typically are available by species, though, rather than by quality and size levels. A compromise was struck by arbitrarily assigning four value levels to North American softwood logs; none corresponds exactly to any current grade found in the marketplace.

- Utility: Submerchantable in the export market even during the crests of business cycles.

- Construction: Competitive with Coast Grade No. 3 saw logs from the Pacific Northwest; that is, competitive with second-growth logs having scaling diameters of 6-12 inches.

- Performance: Competitive with Coast and Cascade Grade No. 2 saw logs from the Pacific Northwest; that is, competitive with second-growth and old-growth logs with scaling diameters between 12 and 24 inches.

- Select: Logs whose principal value derives from appearance-grade lumber.

Utility-grade logs, by definition, are of little interest to the export trade and therefore were not analyzed. Selects enjoy ever-increasing values; their marketability is not in question and was not projected. Although the four assortments are arbitrary, they require benchmark prices and quantities. For early 1987, these are:

	Grade	
Benchmark prices and percentages	**Construction**	**Performance**
U.S. price, f.a.s., per Mbf[1]	$312	$388
Percent of U.S. exports	22.5	77.5
Percent of Canadian exports	15	85
Percent of Chilean exports	100	0
Percent of New Zealand exports	100	0
Percent of Soviet exports	46	54

See next page for footnote and continuation.

Benchmark prices and percentages	Grade	
	Construction	Performance
Percent of Pacific Rim log trade	33	67
Percent of Japanese imports	21	79
Percent of Korean imports	100	0
Percent of Chinese imports	32	68
Percent of Taiwanese imports	0	100

[1] F.a.s. is free alongside ship; that is, the value of logs on the dock that are ready to be loaded. Mbf is thousand board feet.

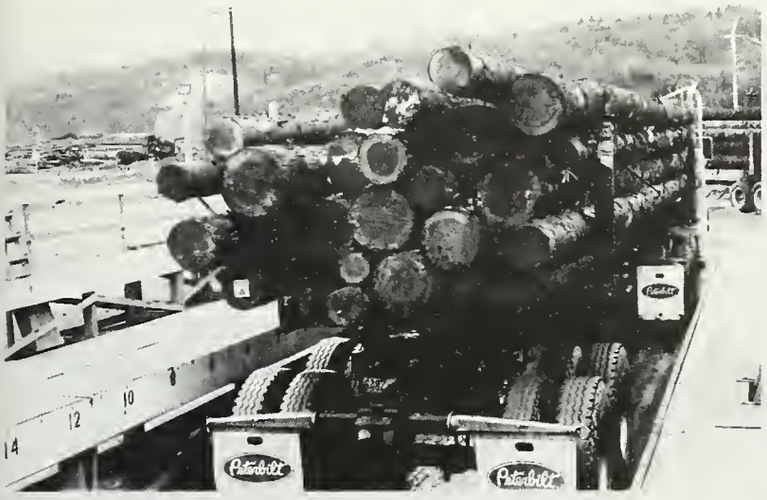
A

A—The tight grain characteristic of select-grade logs.

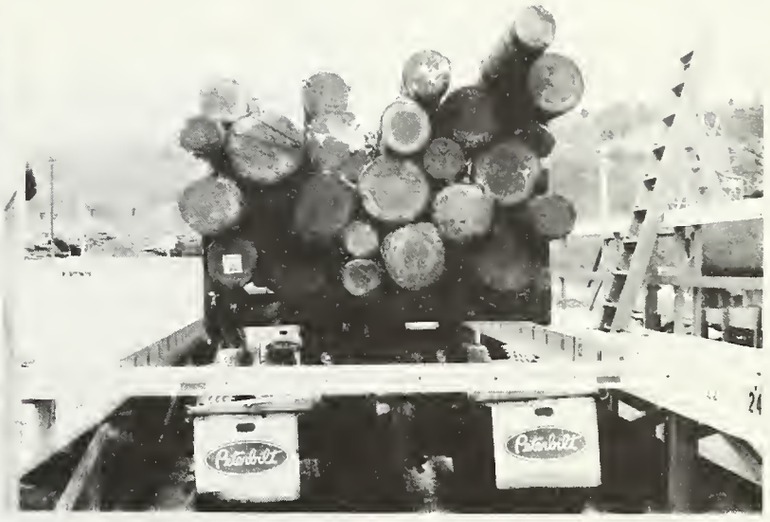
B

B—Large old-growth select-grade logs awaiting shipment.

C



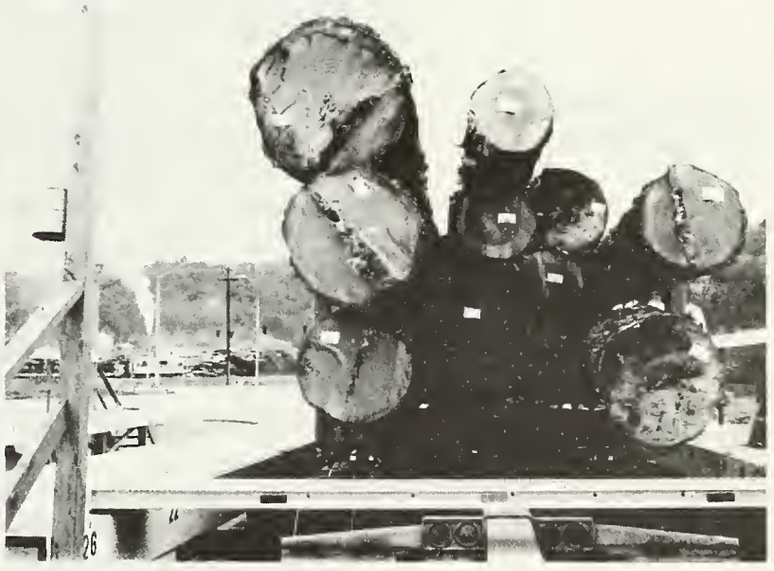
D



C and D—Truckloads of construction-grade logs being scaled.

E

F



E and F—Performance-grade logs at a scaling site.

G

G—Decks of construction- and performance-grade logs, after sorting in the woods.

Making the Projections

Projections of supply and demand were made separately for construction- and performance-grade logs for 1995 and 2000 to estimate future prices, flows, and income from log exports. This was done for each Pacific Rim log-supplying or log-consuming country; results for each were converted to U.S. currency values and adjusted for shipping costs to make prices comparable. The results provided data for figures 1 and 2, in which the aggregated one-country supply curves are plotted with the combined one-country demand curves. Supply curves reflect the economic circumstance of producing countries offering more timber when prices are high than when prices are low; similarly, the demand curves indicate the reduced willingness of consuming countries to buy logs at higher prices.

For each log grade, an equation characterizing the supply or demand of each country was estimated from annual export or import data, generally for 1963-85. The equations are given in the appendix. For construction-grade logs, the equations are updated versions of those used by Flora and Vlosky (1986) but with additional data. For performance-grade logs, these equations correspond to those underlying a 1988 analysis of Alaska log demand (Flora and McGinnis 1989). To produce the supply-demand relations, each equation uses log volumes traded as the dependent variable, and each includes average unit value (price) of logs in that grade among the independent (explanatory) variables. Other independent variables were chosen to include economic factors driving the log trade in each country. In many cases, it was appropriate to choose among closely related variables, such as gross domestic product (GDP) vs. aggregate industrial production. In such cases, variables were chosen that contributed most to reducing the unexplained variance in log shipments as well as having the most significant coefficients statistically.

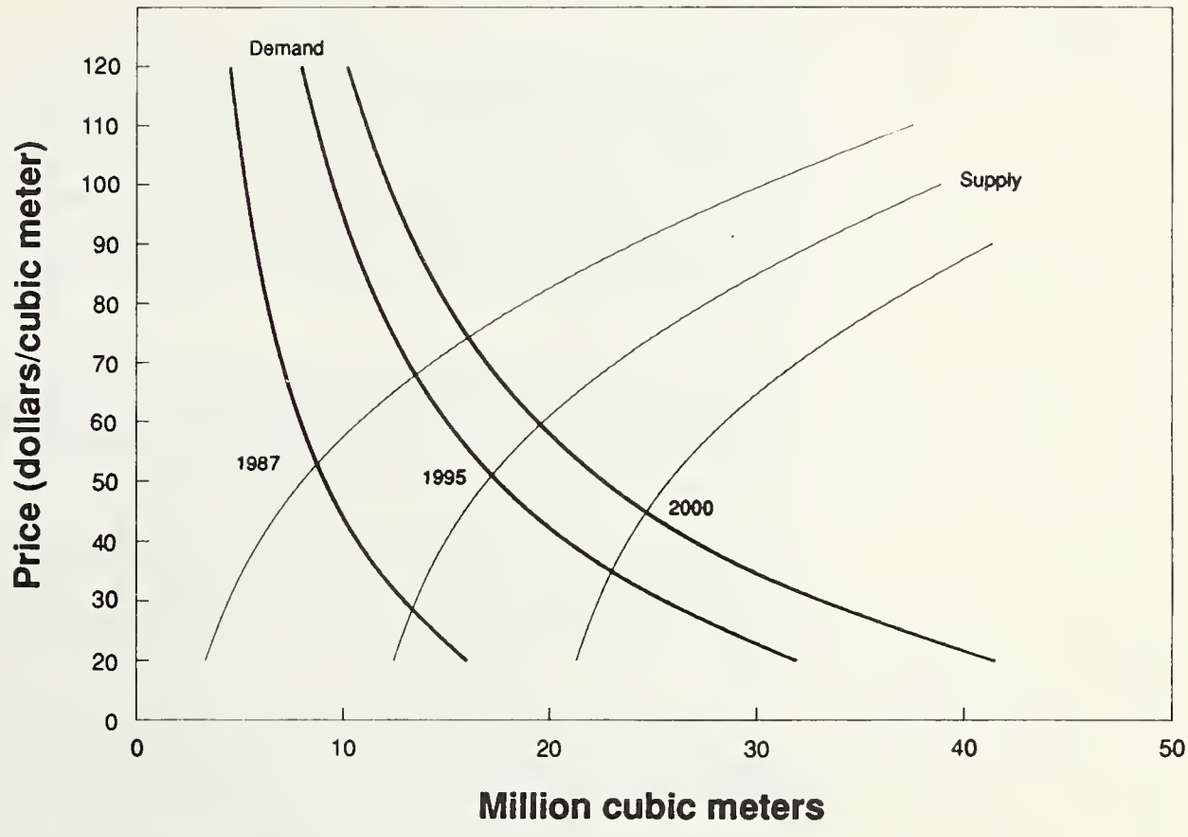


Figure 1—Pacific Rim supply and demand of construction-grade logs.

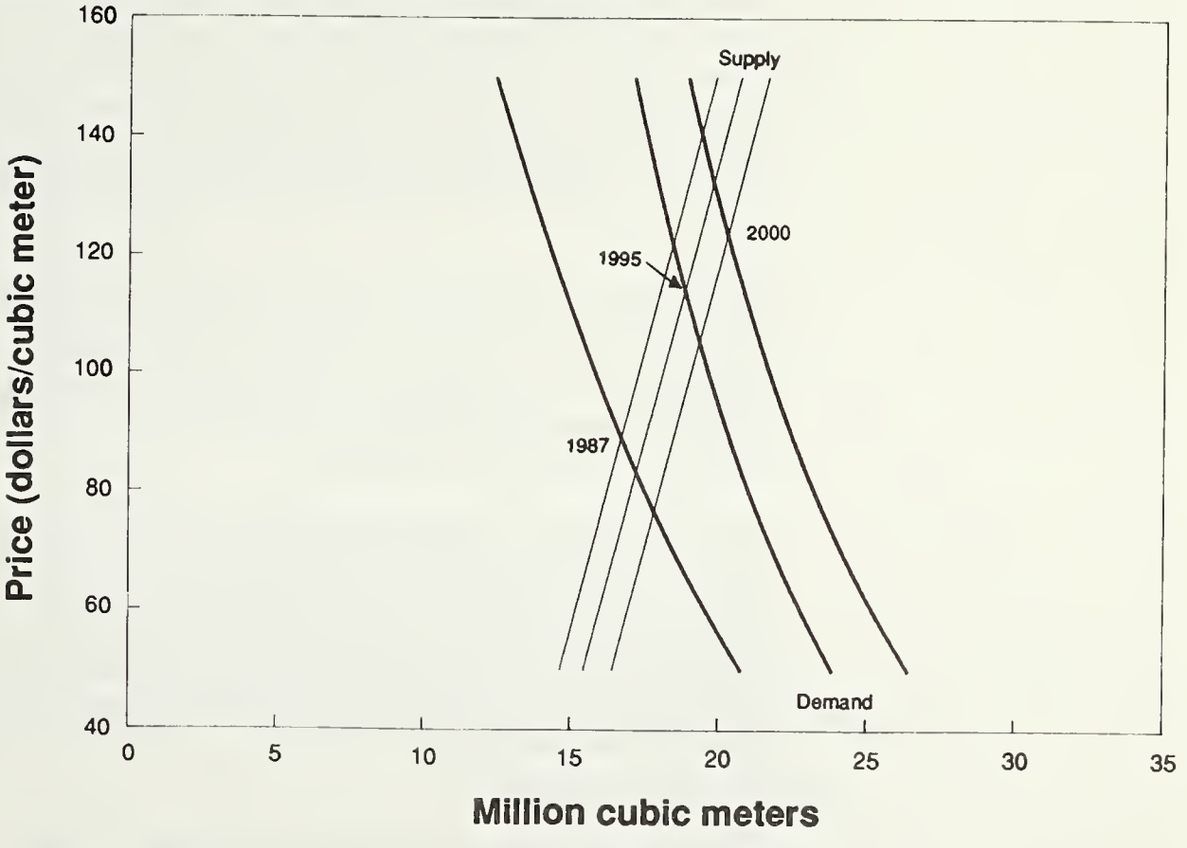


Figure 2—Pacific Rim supply and demand of performance-grade logs.

The sum of official import data does not usually equal the sum of export data for several reasons, including conversion factors used, reporting lags, scaling practices, and accounting years. Indeed, there can be sizable discrepancies between data reported by trading partners who have well-developed trade documentation and compilation procedures, such as Japan and the United States. In this analysis, no attempt was made at reconciliation: the import and export data from each country were used as reported by that country. In general, nations' own customs clearance reports were used.

Because log-trade data are rarely reported by grade, quality class, or economic category, it was necessary to judge the proportions and relative values. They are shown as 1987 values in the section "Results of the Projections." Future volume-share shifts among grades were assumed, as indicated later.

The volume data and economic analyses were prepared in thousands of cubic meters and value per cubic meter. Final results were converted to millions of Scribner board feet and U.S. dollars per Mbf. Exchange rates were those of early 1987 when, for instance, the U.S. dollar was equivalent to 140 yen.

For each country, prices and other economic data were adjusted to real (inflation-compensated) values in 1985 prices, generally by using the wholesale price index of the country. This indicator and other national economic aggregates were either from countries' own Federal agencies or from the International Monetary Fund (1988).

Prices were intended to portray log values at dockside along the U.S. West Coast; that is, f.a.s. Thus demand prices in consuming countries were adjusted for cross-Pacific shipping costs. Estimated freight rates for logs moving across the Pacific ranged from $110 to $150 per Mbf, depending on log size and route. As pointed out above, variations among actual log shipments can be so great as to obscure these differences. Supply prices in countries other than the United States also were adjusted to reflect their competitive positions relative to U.S. logs.

Projections of variables other than price and volume (for example, housing starts and gross national product) were made to 1995 and 2000, so that future supply and demand functions for each country could be expressed solely by price and quantity. Finally, supply functions for each country were summed as were national demand functions. The supply-demand intersections of figures 1 through 4 simultaneously locate future price and future volume.

This process was conducted separately for construction- and performance-grade logs, and it was repeated with different estimates of future Soviet timber supplies and alternative exchange rates. Underlying assumptions about national economic trends affecting the log trade were common to both grade analyses. Economic trends and assumptions by country are summarized below. Details are available of the analysis of performance-grade logs (Flora and McGinnis 1989) and construction-grade logs (Flora and Vlosky 1986).

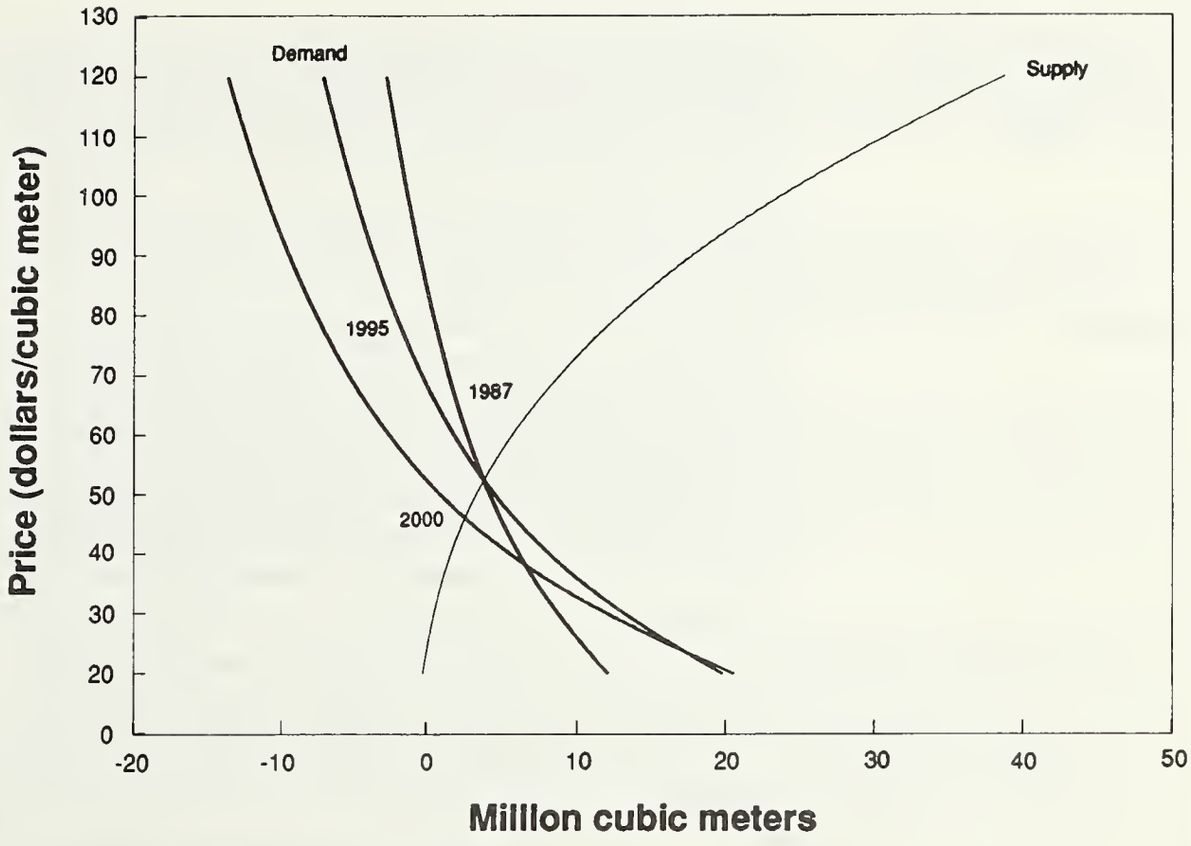


Figure 3—United States supply and demand of construction-grade logs.

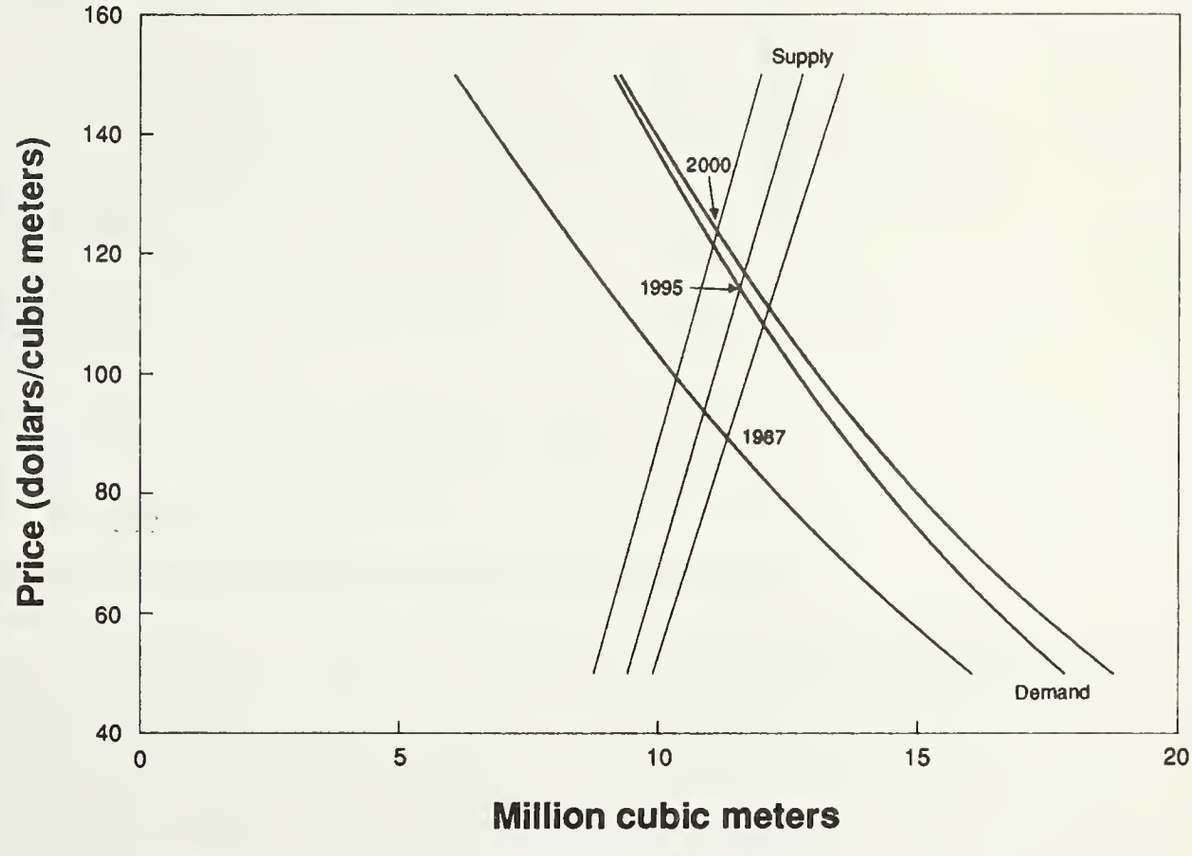


Figure 4—United States supply and demand of performance-grade logs.

Supply Countries

United States

Dynamics of the U.S. domestic log market and the implications for exports have been discussed in detail in earlier sections. The United States has been the principal supplier of softwood logs to the Pacific Rim market. There is a strong correlation between log exports and Pacific Northwest timber harvests; in western Washington, exports account for half of the non-Federal cut. Projections of future export supplies were keyed to harvests in the Douglas-fir region, as estimated for the rest of the century by Haynes and Adams (1985), who expect a modest decline in harvests.

Canada

Although limited by statute and custom, log exports from British Columbia rose during the recession, partially ameliorating coastal employment lost as North American demand declined during the 1980s recession. Since the mid-1960s, export volumes have been somewhat countercyclic in British Columbia as they responded to regulatory adjustments intended to moderate economic cycles. This relation was employed in the projections of Canadian log exports to the Pacific, as were lumber manufacturing costs and U.S. housing starts. Figure 5 shows recent Canadian softwood log exports in all grades to Pacific Rim destinations other than the United States.

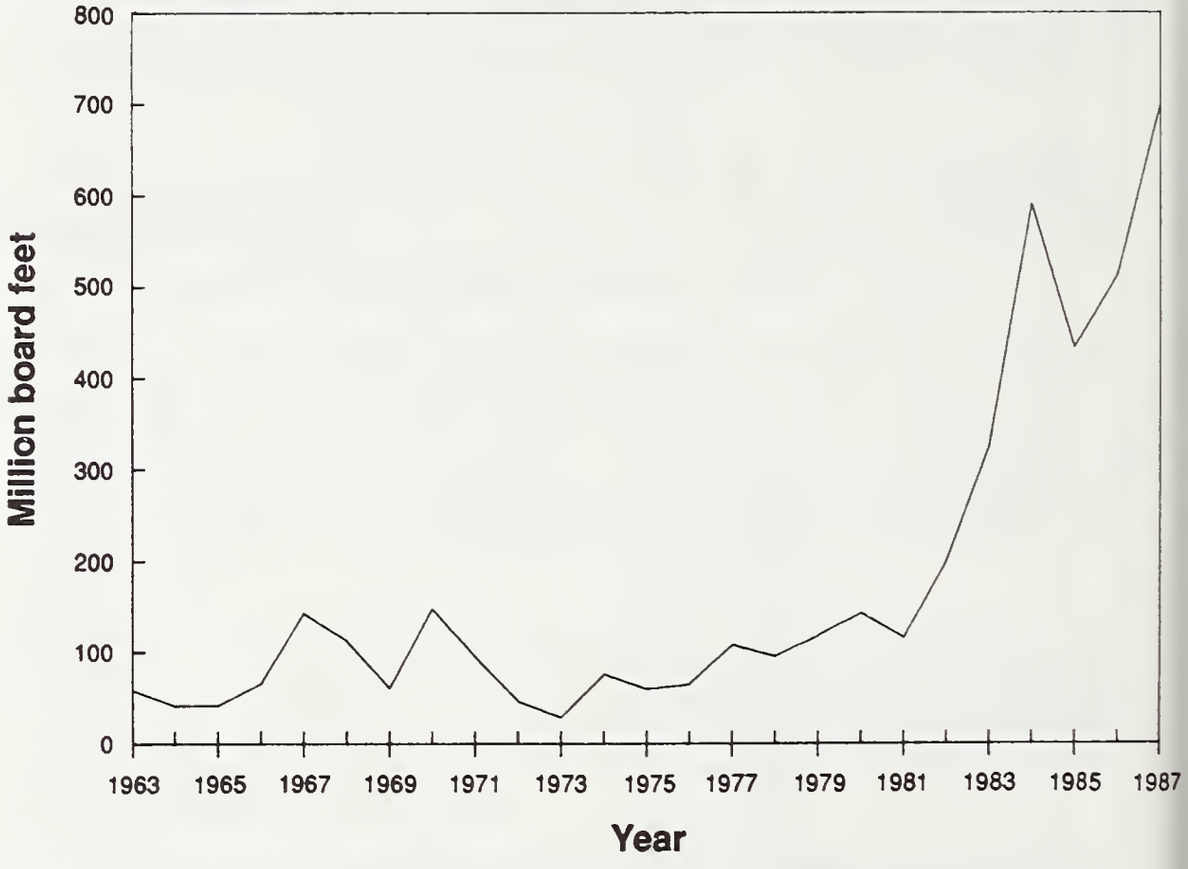


Figure 5—Softwood log exports from British Columbia to the Pacific Rim, 1963-87.

Chile

We assumed, from announced corporate and Federal goals, that Chilean timber producers will emphasize end products rather than logs in the export mix. A companion assumption was that the trend in the export share of the mix will remain roughly constant.

Timber exports in Chile derive mainly from radiata pine (*Pinus radiata* D. Don) plantations, which comprise about 3 million acres. Analysis revealed that log exports are closely related to the area of radiata pine plantations reaching age 23. This correlation was used in the projections.

Increased attention to tree improvement, notably thinning and pruning, and (more significant in the near term) aggressive marketing and quality control are expected to enhance the value of radiata pine such that we assumed 10 percent of the construction-grade log exports from Chile will move into the higher valued performance grades by 1995.

New Zealand

Figures 6 and 7 compare softwood log exports from New Zealand with those of Chile during recent years. Radiata pine from a planted area similar to that in Chile dominates log (and lumber) exports from New Zealand. A surge of planting occurred in the 1930s after decades of heavy cutting to accommodate grazing. Another surge occurred after World War II, especially during the 1960s. Harvesting and domestic demand have driven exporting, with those factors reflected in the supply estimates.

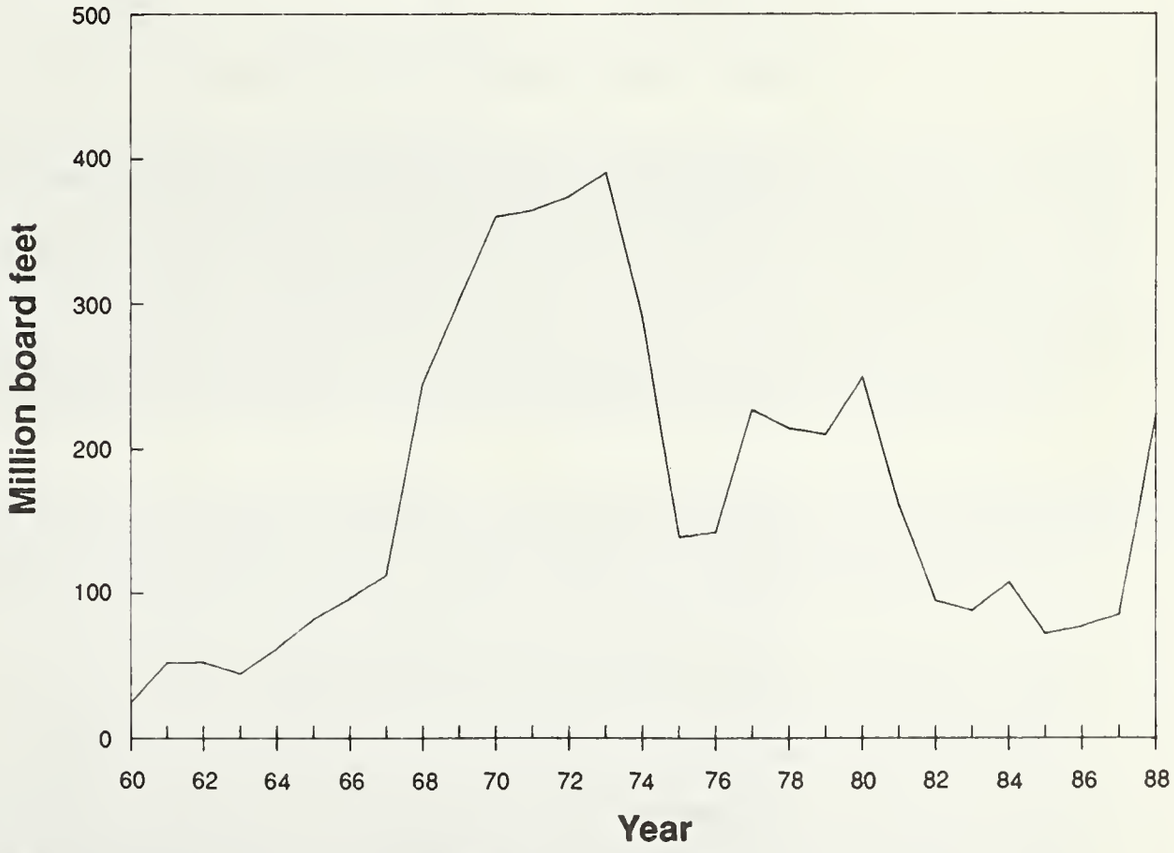


Figure 6—Softwood log exports by New Zealand, 1960-88.

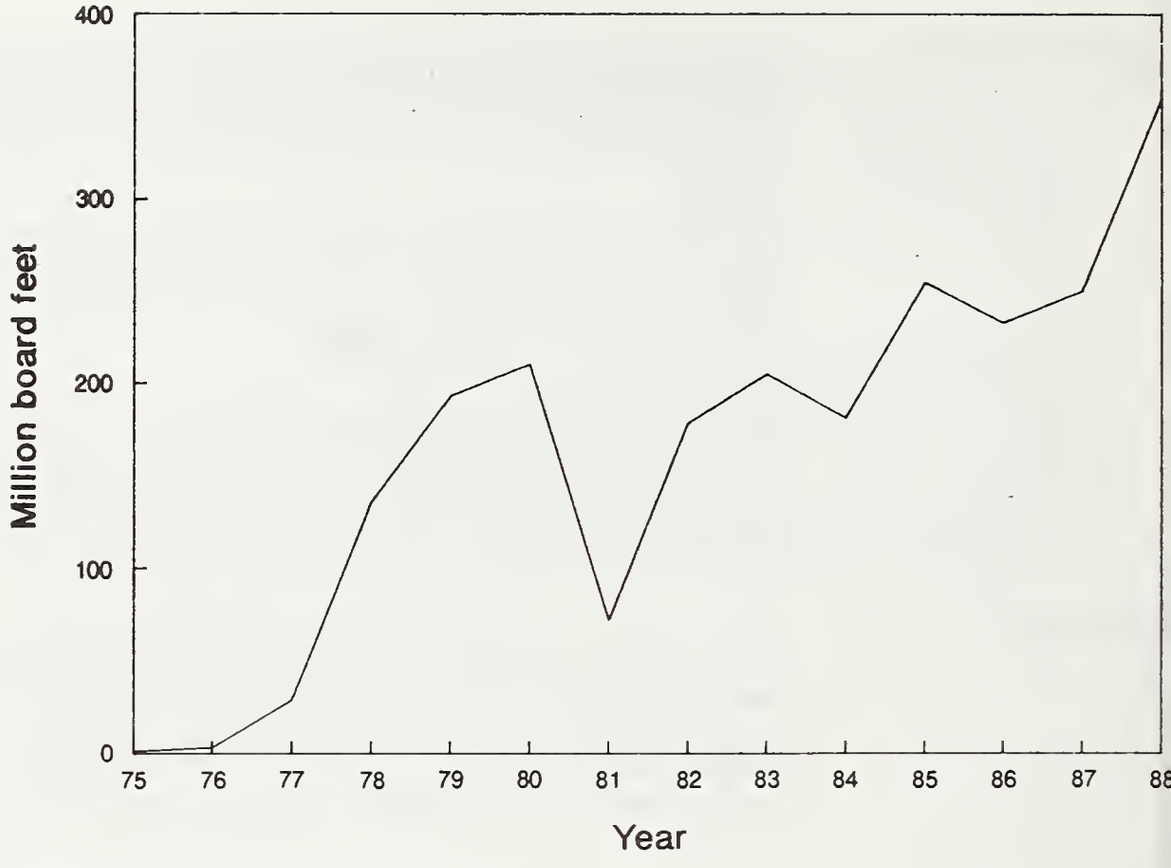


Figure 7—Softwood log exports by Chile, 1975-88.

Privatization of Federal timber production activities in New Zealand in the mid-1980s was assumed to drive efforts in New Zealand to increase market perceptions of the usefulness of radiata pine. Less clear is the outlook for industry choices among export products. We assumed that logs will continue to be preferred by offshore consumers, as they are in the United States, although the value differential between logs and lumber may be greater for radiata pine than for North American species. We assumed that, by 1995, 15 percent of the construction-grade offerings from New Zealand will have benefitted from marketing efforts and moved into performance grades, with 20 percent shifting by 2000.

Soviet Union

Soviet log exports to Pacific Rim countries have followed the trajectory shown in figure 8. Completion of a second east-west railway through eastern Siberia and the Soviet Far East in the early 1980s, plus expanded port facilities at the Pacific terminus, created opportunities for expanded timber shipments eastward. Although a severe winter climate, sparse population, and scant roads are impediments, experience in similar regions in the rail belt of interior Alaska and in northern Canada suggest the potential for export expansion. An adverse foreign exchange situation, a new emphasis on private sector initiative, and administered cost and pricing structures are considered strongly favorable for log exporting, as is the fact that the new railway, perhaps intended primarily for nontimber transport, traverses 2,000 miles of timberland. But a recent surge of public interest in environmental protection has apparently expressed itself in many of the timber-oriented regions of the country, including the Far East.

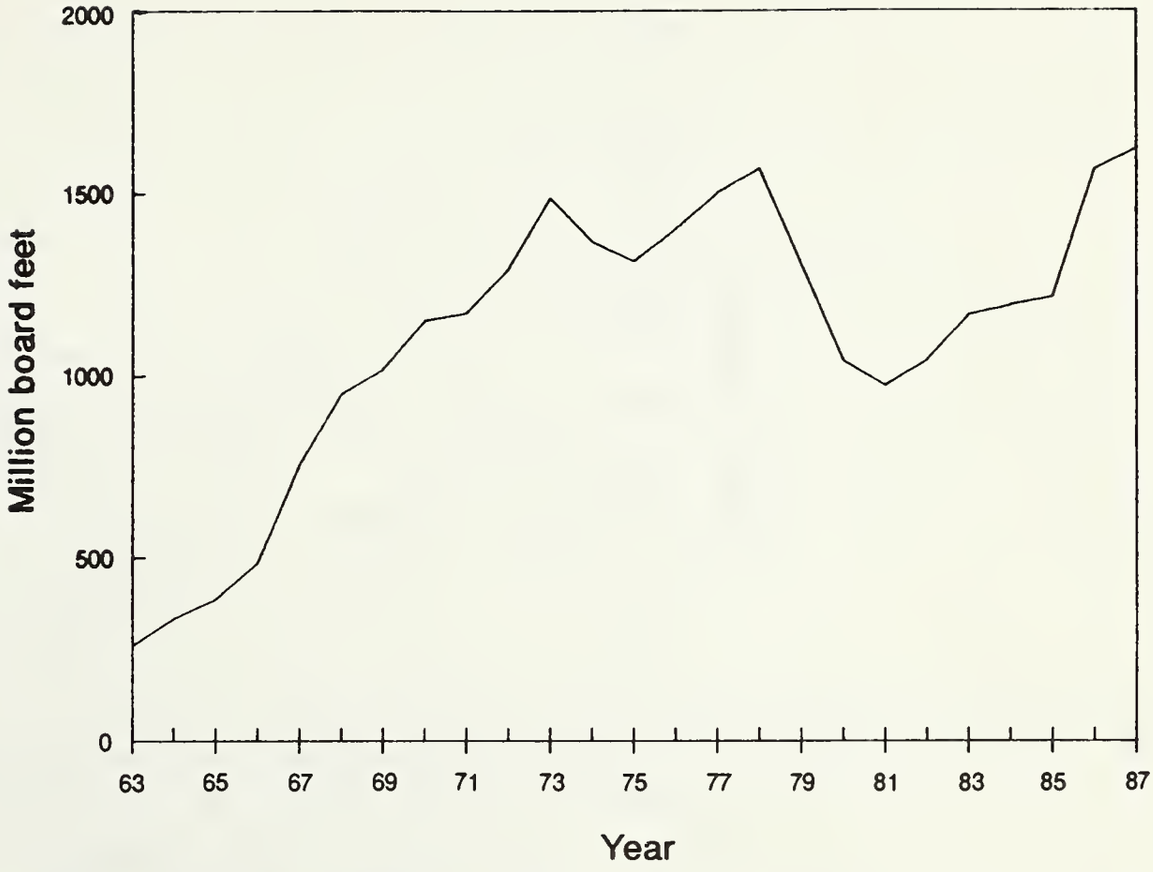


Figure 8—Softwood log exports from the U.S.S.R. to the Pacific Rim, 1963-87.

Because Soviet timber supplies are only indirectly price responsive (Flora and Vlosky 1986), we assumed that exports of performance-grade logs will expand 3 percent per year through 2000, with construction grades growing at 5 percent per year. A major destination is expected to be China, not because of the new railway but because of the economic convenience of cross-border barter trade. Barter seems to be involved in much of the U.S.S.R.-China trade (Nomura 1988). An annual 5-percent increase would be significant in Soviet log exports; therefore, an alternate scenario with an increase of 3 percent per year was developed. Results of both assumptions are reported here.

Demand Countries

Japan

Japanese economic expansion since World War II is well known. By 1988, depending on how one defines economic welfare and handles currency differences, average household income in Japan is either well below or just above that in the United States. Rising incomes have expanded both the number and size of housing starts.

During the early 1980s, the rate of economic growth in Japan declined from about 10 percent per year in the 1970s to about 5 percent per year, well above the U.S. rate in the 1980s of 2 to 3 percent annually. Changes in the rates of household formation and migration to cities, the latter favoring high-rise concrete construction, are not considered favorable for softwood log demand. There is also a potential for offsetting supplies from 25 million acres of plantations in Japan, which are mostly softwoods. Domestic forests currently account for about half of the lumber production in Japan. Figure 9 shows recent log imports by Japan.

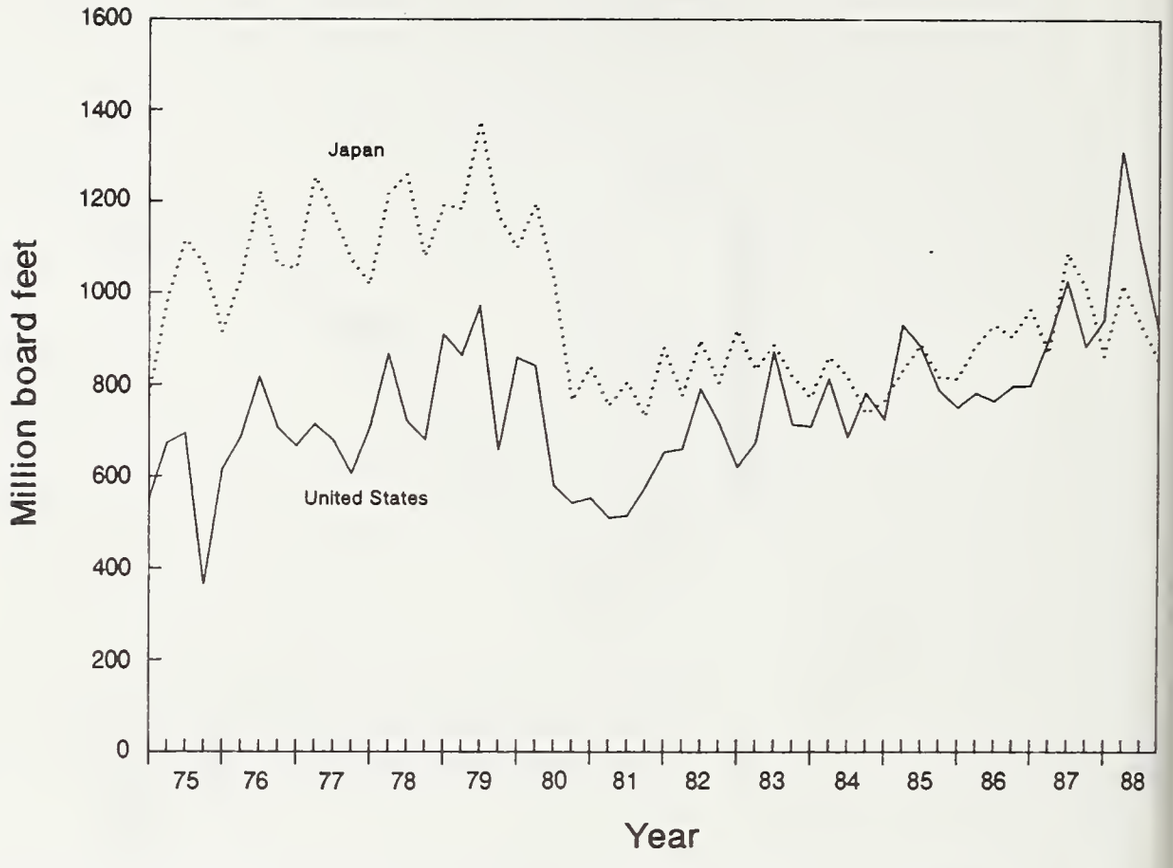


Figure 9—United States exports and Japanese imports of softwood logs by quarter, 1975-88.

Future wood-based construction was estimated from Ueda and Darr (1980), with an adjustment for nonresidential wood-based construction. We assumed that the floor area of residential wood structures will remain constant and industrial wood buildings will double between 1987 and 2000, thereby reflecting the assumed national economic growth of 4 percent per year to 1990 and 5 percent thereafter.

Korea

Figure 10 charts Korean (Republic of Korea) imports of softwood logs, almost all of them construction grade. Indeed, Korea has been the major outlet for small logs from the North American coast.

Log imports have been highly correlated with economic growth in Korea. This relation was used to project log imports, with economic growth estimated at 8 percent per year through 1990 and 6 percent annually thereafter, all in real (inflation-compensated) terms.

China

Softwood log imports to the People's Republic of China (China), which come primarily from the U.S.S.R. and North America, have created a market niche between the lower grades used by Korea and the higher grades sought by Japan. Rising rapidly in 1979 and 1980, imports fell sharply in mid-decade (fig. 11). The decline was attributable to exhaustion of foreign exchange, a condition affecting most imports to China. Modestly improved trade balances and import priorities in favor of basic materials and manufacturing goods are expected to support a slow but steady increase in log imports in the 1990s.

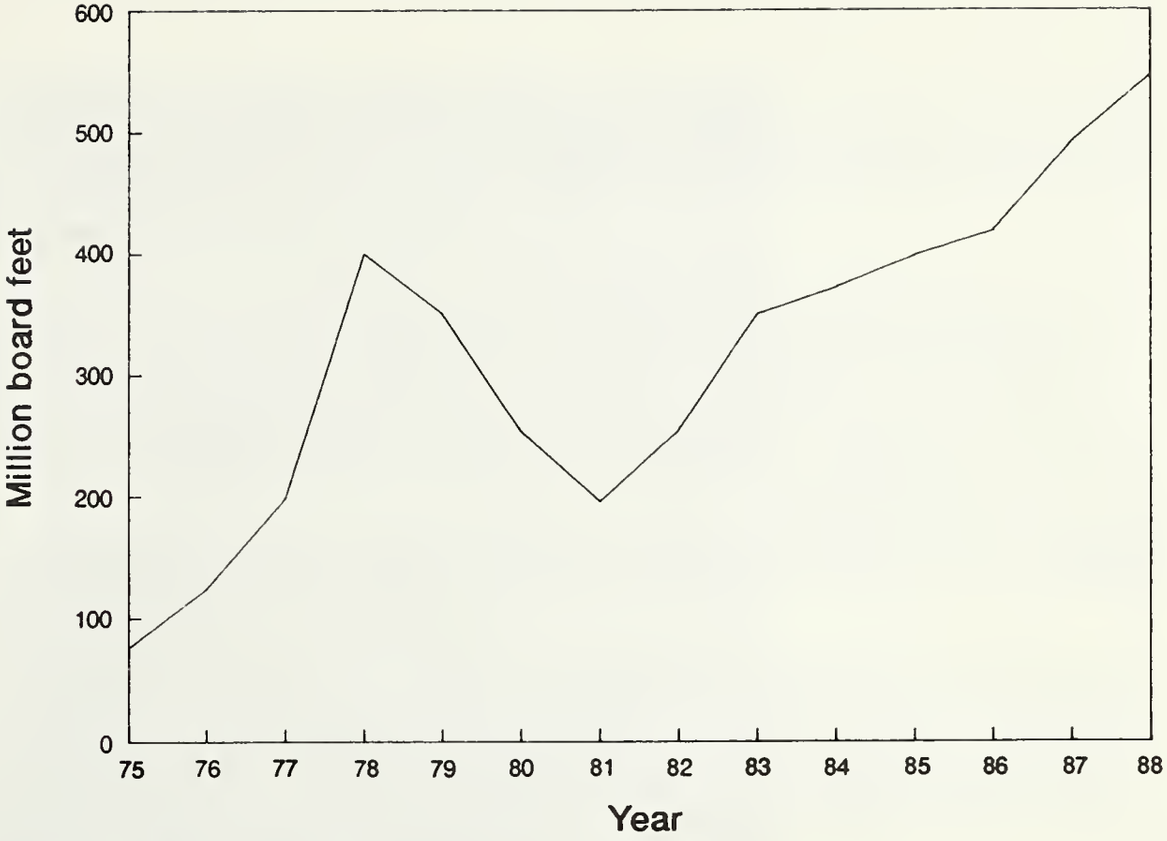


Figure 10—Softwood log imports by Korea, 1975-88.

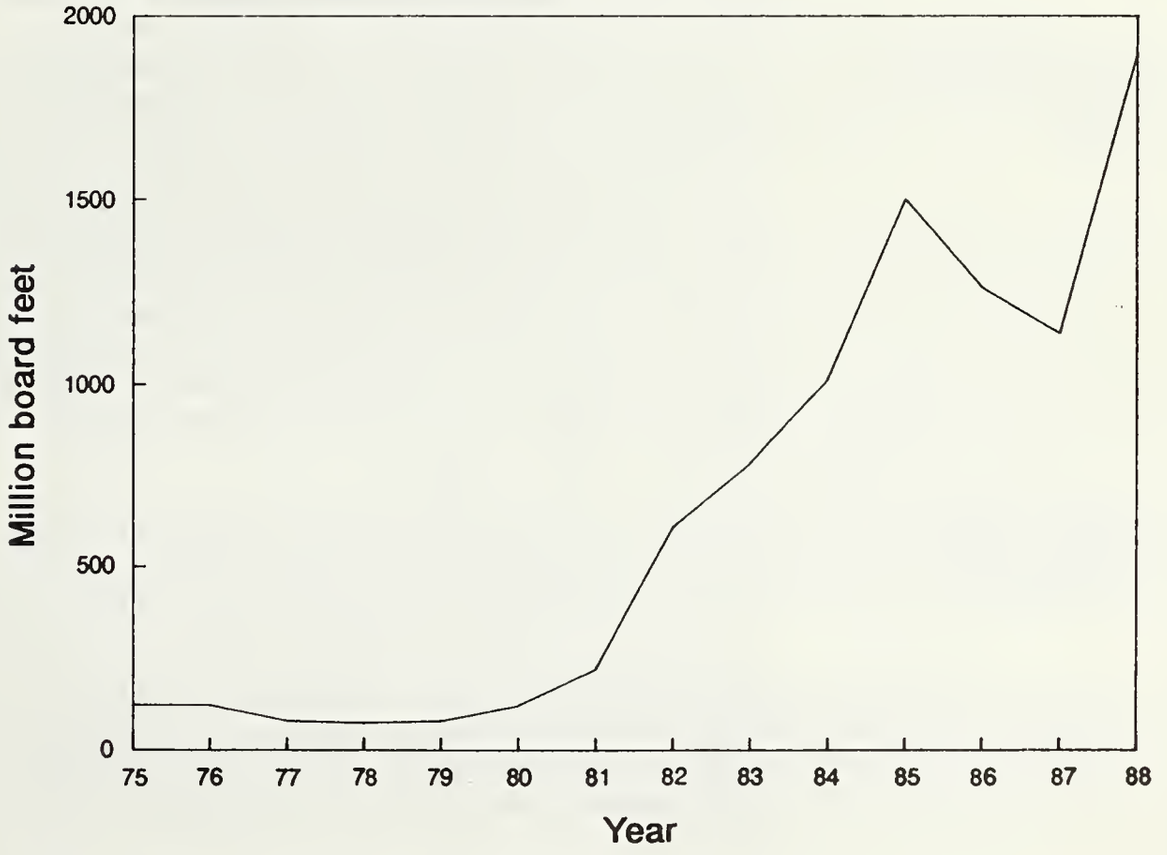


Figure 11—Softwood log imports by China, 1975-88.

Because of the foreign exchange constraint, the aggregate value of Chinese log imports has been strongly related to the capacity of China to support imports; that is, to national income. Given a relation between spending on logs and national income, the volume of log purchases can be determined by dividing spending by the average price of log purchases. This approach was used in projecting future consumption of foreign logs by China. It was assumed that national income would increase 8 percent per year through 1990 and 6 percent per year subsequently, both figures in real terms. Although these rates are the same as those assumed for Korea, the assumption for Korea had an increase in annual percentage change, while that for China had a decrease from the 10- to 15-percent rates of the early 1980s. The economic-growth assumptions for China are, of course, highly speculative considering the political and economic uncertainties introduced in mid-1989.

Taiwan

Although the Republic of China (Taiwan) has imported few softwood logs, the country has drawn on a domestic supply of softwood timber. That supply has been in decline for at least two decades. Estimates of future imports were based on prices and volumes of indigenous softwood logs since the early 1960s. Demand and supply were estimated separately and then consolidated. As in other countries, log consumption has been strongly related to national economic growth on the demand side; supply has declined steadily along a trend line, after annual prices are accounted for. We assumed that the economy of Taiwan will roughly parallel that of Korea and mature in the late 1990s, after following the rapid development trajectory characteristic of Japan. Adjusted for inflation, future economic growth therefore was assumed at 8 percent through 1990 and 5 percent thereafter.

The Emphasis on Trends

A separate report (Flora and others, in press) underscores the presence of economic cycles in the business world at large and, in particular, in the timber sector. Multiyear fluctuations since the late 1960s have lengthened and intensified; yet, accurate forecasting of their timing and dimensions has eluded economists, as the futile near-consensus about a recession in the mid-1980s demonstrated. Projections in this report, therefore, are designed to estimate average trends and to cut through year-to-year price and volume undulations to portray general tendencies for 10 and 15 years. To this end, the projections slant from a base point at neither the top nor the bottom of an economic cycle, but rather about midway. We selected early 1987 as the benchmark. Log-price trends relate to those prevailing in the first half of 1987, and volumes similarly are compared to the annual rate of exports, seasonally adjusted, in the first two quarters of 1987.

Results of the Projections

Projections for construction-grade logs are shown in figure 1. To prepare the figure, we combined individual 1987 demand curves for importing countries into a Pacific Rim total. The same thing was done for 1995 and 2000. Supply curves for exporting countries were summed separately for those years. The supply-demand intersection for 1987 pinpoints the price and quantity appropriate to that year: $52 per cubic meter (cum) and 8.8 million cum. These figures correspond to $312 per Mbf at dockside in the United States and about 1.5 billion board feet shipped among all Pacific Rim trading countries. Projected curves for 1995 and 2000 are also shown in figure 1; their intersections are interpreted the same way.

Figure 2, for performance-grade logs, is read identically; for instance, the 1987 intersection is at $86 per cum and 16.8 million cum, corresponding to $388 per Mbf and 3.7 billion board feet. The different shapes of the supply curves reflect the kinds of equations used (see appendix).

Figure 3, for construction grades, is based on the same equation sets and curves as figure 1. Figure 3 coalesces all demand and supply curves except the supply curve for the United States, which is shown separately. The result is a net Pacific Rim demand curve facing the United States in 1987 and crossing the U.S. supply curve. The 1987 price is the same as in figure 1, but the volume is specific to the United States—3.6 million cum (about 600 million board feet). The supply-demand intersections for 1995 and 2000 are interpreted as in figure 1. There is only one supply curve in figure 3 because, for the United States, supply is assumed to not shift over time. The seemingly erratic movement of the net demand curves reflects variegated long-term changes among countries.

Figure 4, for performance-grade logs, is comparable to figure 3; it is supply-specific for the United States, but consolidates offshore demands with non-U.S. supplies. Thus the net demand facing the United States is shown with the U.S. supply of performance grades. Demand expands over time and supply contracts, which raises prices (consistent with fig. 2). The higher prices induce relatively constant U.S. exports despite the leftward shift of the U.S. supply curve.

Prices are expected to remain stable, relative to early 1987, in real (inflation-compensated) terms for construction-grade logs and to rise 34 percent for performance grades by 1995. From 1995 to 2000, prices are expected to decline 13 percent and increase 8 percent for construction- and performance-grade logs, respectively.

United States export volumes in the upper grades are projected to remain constant until 1995; by 2000 they are expected to decline about 5 percent because of declining availability in both Alaska and the Pacific Northwest. For the lower grades, we assumed that supplies from the United States will be relatively constant through 2000. The analysis indicated expanding offshore supplies, which would cause the demand facing the United States to decline after 1995. United States shipments are expected to decline by one-third for construction grades. Aggregate annual U.S. log shipments are projected to increase 2 percent by 1995 (in cubic-scale terms) and decline 11 percent between 1995 and 2000. Shipments of utility logs are expected to remain negligible. Although selects were not analyzed systematically, it seems that selects will hold their demand while declining in availability, so that prices will rise; the higher prices are expected to hold shipped volumes at a relatively constant level despite greater scarcity.

Relative to the base period, annual movements of construction-grade logs among Pacific Rim countries are expected to double by 1995, and performance grades are projected to gain 12 percent; combined, their volume gain is expected to be 36 percent. Relative to 1995, the 2000 aggregate volume is estimated to grow 29 percent.

The considerable difference between construction and performance grades reflects the greater abundance, relative to demand, expected for the lower grade material. The supply gains around the Pacific Rim are primarily attributable to increases from Chile, New Zealand, and the U.S.S.R., with most of these shipments in the lower grades. Specific quantitative results for performance grades are:

	Year		
Volume and price	**1987**	**1995**	**2000**
Base projection:			
U.S. export volume—			
Billion board feet	2.53	2.58	2.48
Million cum	11.4	11.6	11.2
Total Pacific Rim exports—			
Billion board feet	3.73	4.18	4.49
Million cum	16.8	18.8	20.2
Average log price, f.a.s.—			
U.S. dollars per mbf	388	520	560
U.S. dollars per cum	86	115	124
U.S. dollar falls 10 percent below 1987, except 20 percent against the yen:			
U.S. export volume—			
Billion board feet		2.69	
Million cum		12.1	
Total Pacific Rim exports—			
Billion board feet		4.31	
Million cum		19.4	
Average log price, f.a.s.—			
U.S. dollars per mbf		576	
U.S. dollars per cum		128	

Specific quantitative results for construction grades are:

	Year		
Volume and price	**1987**	**1995**	**2000**
Base projection:			
U.S. export volume—			
Billion board feet	0.61	0.61	0.41
Million cum	3.6	3.6	2.4
Total Pacific Rim exports—			
Billion board feet	1.47	2.67	4.11
Million cum	8.8	16.0	24.6
Average log price, f.a.s.—			
U.S. dollars per Mbf	312	312	270
U.S. dollars per cum	52	52	45

Volume and price	Year		
	1987	1995	2000
Soviet export growth 3 percent per year instead of 5 percent:			
U.S. export volume—			
Billion board feet		0.73	0.49
Million cum		4.4	2.9
Total Pacific Rim exports—			
Billion board feet		2.8	4.0
Million cum		16.9	23.6
Average log price, f.a.s.—			
U.S. dollars per Mbf		330	294
U.S. dollars per cum		55	49

Analysts are interested in the price elasticities of supply and demand: the proportional change in quantity associated with a proportional change in price; for example, with an elasticity (supply or demand) of 1.5, quantity changes 1.5 percent with a 1-percent change in price. Price elasticities of the 1987 supply and demand functions, at the 1987 price levels, are:

Function	Grade	
	Construction	Performance
Pacific Rim supply	1.30	0.28
Pacific Rim demand	–.64	–.46
U.S. supply	.40	.31
Offshore demand facing United States	–1.95	–.80

If Soviet supplies of construction-grade logs increase an average of 3 percent per year instead of the 5 percent assumed above, then prices for that category will rise 6 percent by 1995 and decline 11 percent by 2000. By 2000, prices facing the United States would be 9 percent higher and U.S. shipments would be 20 percent greater for this log stratum than if Soviet exports increased 5 percent per year.

More significant to the log trade would be a further decline in the value of the U.S. dollar. If it should decline, by 1995, 20 percent relative to the yen and 10 percent relative to other currencies, performance-grade log prices can be expected to be 12 percent higher than with constant exchange rates at the early-1987 level and increase 61 percent instead of 45 percent. Export volumes from the United States could be expected to be 13 percent higher than otherwise; that is, increase by 15 percent instead of 2 percent from early 1987. These findings are based on an assumption that 2 years will elapse at the lower currency value while a sequence of adjustments, leading to an equilibrium level, occurs (Flora and others, in press).

Conclusions

Substantial increases in prices of performance-grade logs are expected, even though anticipated supply limitations are expected to keep U.S. exporters from responding significantly to the higher returns. For construction grades, prices are estimated to remain roughly constant into the 1990s and then decline as a result of rising offshore supplies. For U.S. exporters, the price decline, coupled with an assumed constant level of Pacific Northwest harvests in these grades, is projected to reduce export volumes by 2001. These projections are sensitive to several factors; for instance, a reduced value of the U.S. dollar or a lower rate of Soviet log exports, relative to those assumed here, would be quite favorable for U.S. log sales.

The conclusions and the numerical results underlying them are based on estimates of economic trends in economic and export affairs, and not on short-term cycles. United States export log prices have declined substantially at times. Between 1968 and 1988, there were cyclic increases of 200, 96, and 60 percent, with intervening decreases of 22 and 35 percent. On balance, prices have trended upward, but that incline has been invisible much of the time, particularly as prices are adjusted for inflation (fig. 12). There is no apparent reason why fluctuations will not continue; indeed, the length and intensity of timber-economy cycles have increased. The reader should expect, then, that the rather modest upward price trends projected in this report may be largely obscured by cyclic events along the way.

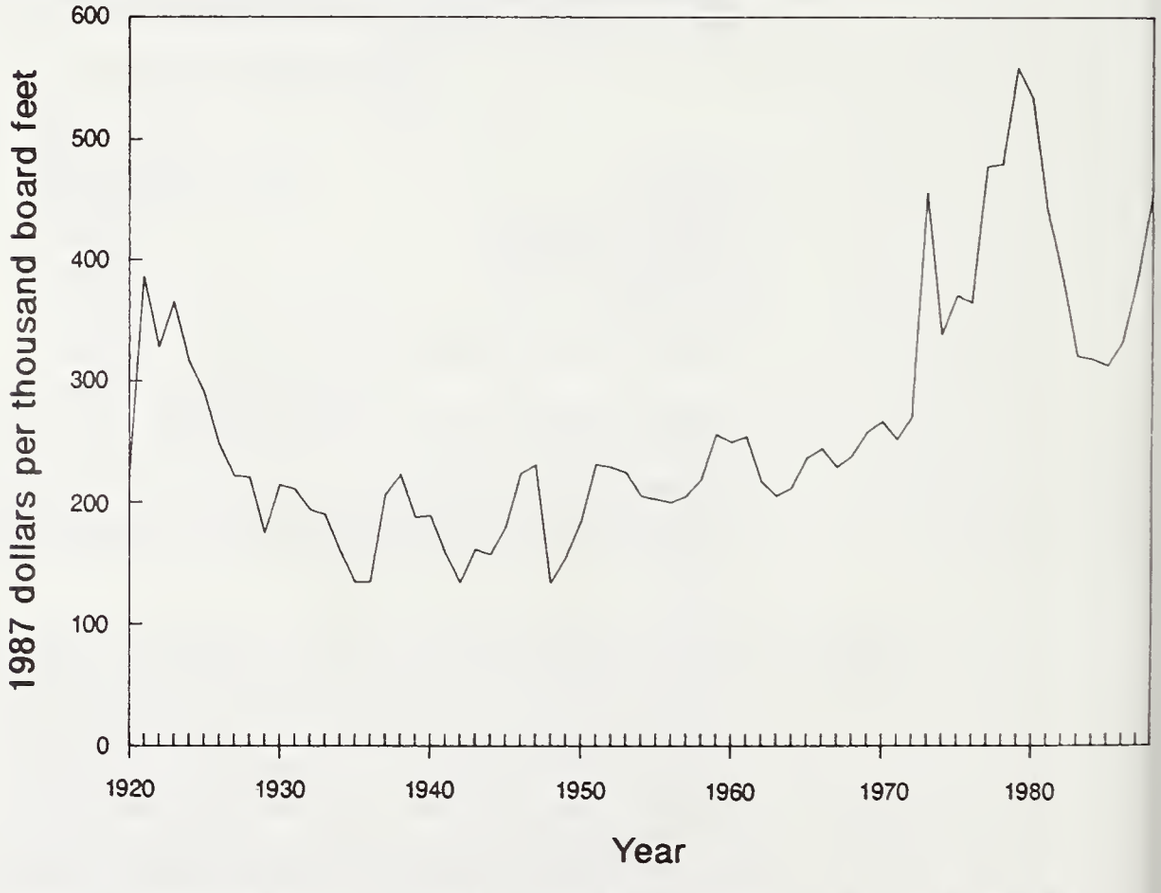


Figure 12—Average real price of U.S. softwood log exports to all destinations, 1920-88, in 1987 dollars.

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Appendix: Supply and Demand Equations

Below are the country-level supply and demand equations from which aggregate Pacific Rim supply and demand relations were summed. These are dockside equations; f.a.s. for supply equations, and for demand functions, c.i.f. (value when the shipment arrives abroad; an abbreviation of cost, insurance and freight). They are in local currency adjusted for inflation to 1987 prices. Other values are T-values in brackets; DW is the Durbin-Watson statistic; and R^2 is the adjusted coefficient of determination, usually called R-bar-squared. F is the F-statistic for the regression.

Construction grades[1]

Canada—

VOL = 12 + 1.50 PRICE + 127.7 SWITCH1 – 0.000518 RBCGDP

[0.45] [1.40] [9.94] [–0.92]

R^2 = 0.86 F = 44 DW = 1.35

[1] Variables are defined at the end of the equation list.

Chile—
VOL = –12742 + 0.0508 PRICE + 0.1805 AREA23 + 61.109 YEAR

[–4.53] [3.98] [7.23] [4.48]

R^2 = 0.95 F = 59 DW = 2.28 Data 1975-85

China—The numerator, representing total spending on softwood logs, was established stochastically:
VOL = (137980 + 553 CININC) / PRICE

[6.67] [8.46]

R^2 = 0.90 F = 72 DW = 1.03 Data 1977-85

Japan—
Ln VOL = –8.2595 – 1.0944 Ln PRICE + 2.4234 Ln FLOOR

[–2.51] [2.11] [9.09]

R^2 = 0.87 F = 75 DW – 1.12

Korea—
Ln VOL = 8.7957 – 1.359 Ln PRICE + 1.266 Ln GDP

[1.90] [–3.16] [16.24]

R_2 = 0.92 F = 132 DW = 1.68

New Zealand—
VOL = –161 + 12.44 PRICE + 62.46 AREA40 – 0.0352 STARTS

[–0.27] [2.28] [8.87] [–3.02]

R_2 = 0.77 F = 29 DW = 1.37 Data 1960-85

Exports were adjusted upward for post-1960 planting, by 1750 thousand cum in 1995 and 3750 in 2000.

U.S.S.R.—No equation was used because export volumes to the Pacific were assumed to increase 5 percent (alternatively, 3 percent) per year.

United States—
Ln VOL = –3.9285 + 2.6611 Ln PRICE + 0.2955 SWITCH2

[–2.54] [7.05] [6.17]

R^2 = .79 F = 42 DW = 2.44

Performance grades

Canada—
VOL = 1592 + 11.75 PRICE – 9.313 MILLCOST + 0.386 USSTARTS

[2.57] [2.35] [–3.03] [2.04]
+ 980 SWITCH3 – 95 SWITCH4
[5.02] [–3.07]

R^2 = 0.78 F = 12 DW = 1.26

China—
VOL = (868489 + 1174 CININC) / PRICE

[6.67] [8.46]

R^2 = 0.90 F = 72 DW = 1.03 Data 1977-85

Japan—
VOL = 2210 – 0.179 PRICE + 0.199 FLOOR

[0.22] [–1.30] [9.67]

R^2 = 0.88 F = 82 DW = 1.33

Taiwan—
Supply: Ln VOL = 232.9333 + 0.3119 Ln PRICE – 0.1158 YEAR

[3.73] [2.37] [–6.18]

R^2 = 0.93 F = 71 DW = 2.70 Data 1971-81

Demand: Ln VOL = 5.1153 – 0.7087 LN PRICE + 1.2988 Ln GDP

[1.38] [–1.78] [8.89]

R^2 = 0.90 F = 48 DW = 0.84

U.S.S.R.—Exports to the Pacific were projected to increase 3 percent per year, with price insensitivity.

United States—
Ln VOL = –68.7279 + 1.3906 Ln PRICE – 1.6064 SWITCH5

[–5.09] [4.82] [–4.50]
+ 0.0355 YEAR + 0.9722 Ln WESTSIDECUT
[4.97] [3.30]

R^2 = 0.93 F = 71 DW = 1.66

Where:

VOL	Softwood log volume imported from or exported to Pacific Rim countries in thousand cum. Canada-U.S. trade is excluded.
PRICE	Inflation-compensated price in units of local currency per cum.
GDP	Gross domestic product in billions of local currency units and compensated for inflation.
CININC	China's national income in billions of yuan and compensated for inflation.
RBCGDP	GDP in British Columbia in millions of Canadian dollars and compensated for inflation.
MILLCOST	Inflation-compensated sawmilling cost per thousand board feet in Canadian dollars.
AREA23	Area of plantations reaching age 23 in thousands of hectares.
AREA40	Area of plantations reaching age 40.
FLOOR	Floor area of new construction in thousand square meters.
STARTS	Number of housing starts in thousands.
USSTARTS	U.S. housing starts.
WESTSIDECUT	Timber harvest in western Washington in billions of board feet.
SWITCH1	Spliced linear dummy variable: 1982 = 1; 1983 = 2; 1984 = 3; 1985 = 2; 0 thereafter.
SWITCH2	Linear dummy variable: 1 to 6 from 1980 through 1985; 6 thereafter.
SWITCH3	Intercept dummy: 1 for 1979-85.
SWITCH4	Linear dummy: 1 to 9 from 1975 through 1983; 0 thereafter.
SWITCH5	Log-linear dummy variable: ln price minus ln $82; 0 when the difference is negative.

☆U.S. GOVERNMENT PRINTING OFFICE: 1991 - 591-001/40016

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By 2000, prices are expected to rise significantly for medium-grade logs and modestly for low-grade logs. World economic cycles may obscure, however, the upward price trends. Exports from the United States of medium grades are expected to remain stable, while volumes of lower grades are projected to remain level through 1995 and then decline because of competition.

Keywords: Markets (external), supply and demand (forest products), trade (Pacific Rim), log exports.

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